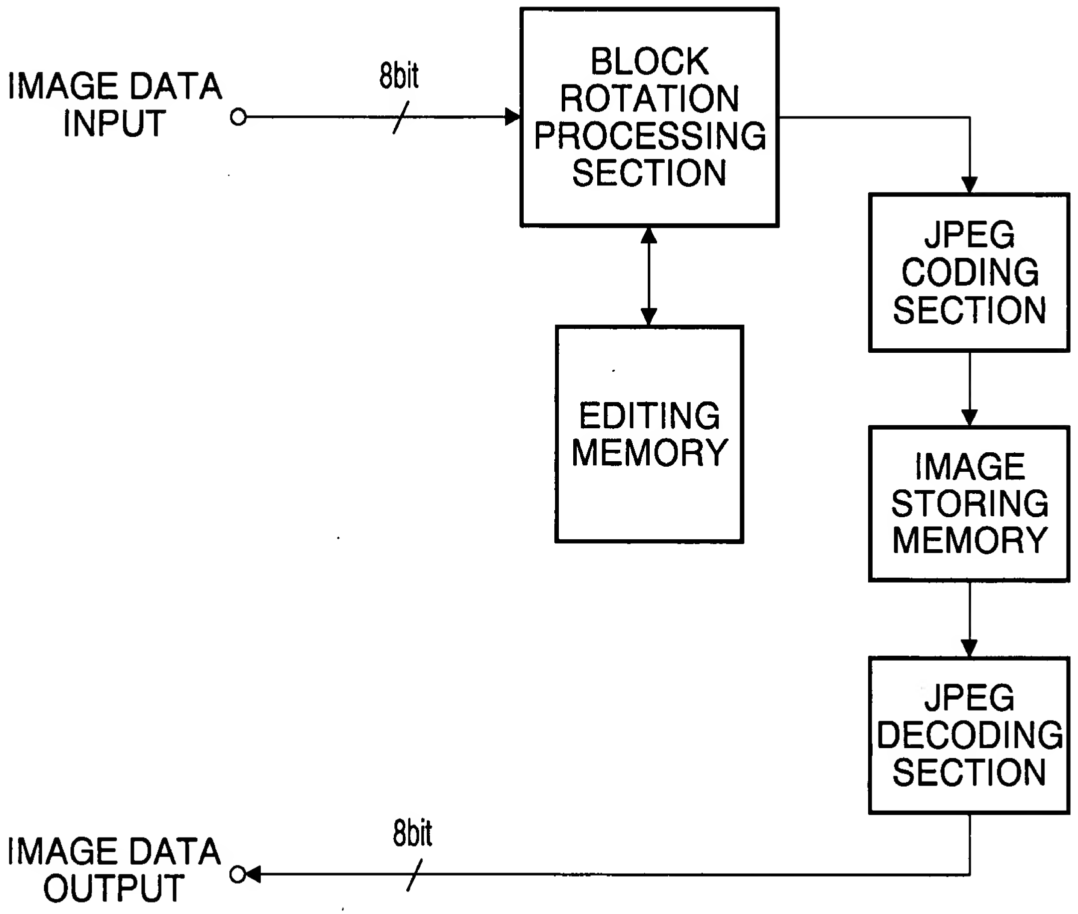


IMAGE DATA
INPUT
8bit
BLOCK ROTATION PROCESSING SECTION
EDITING MEMORY
JPEG CODING SECTION
IMAGE STORING MEMORY
JPEG DECODING SECTION
8bit
IMAGE DATA
OUTPUT

FIG. 1

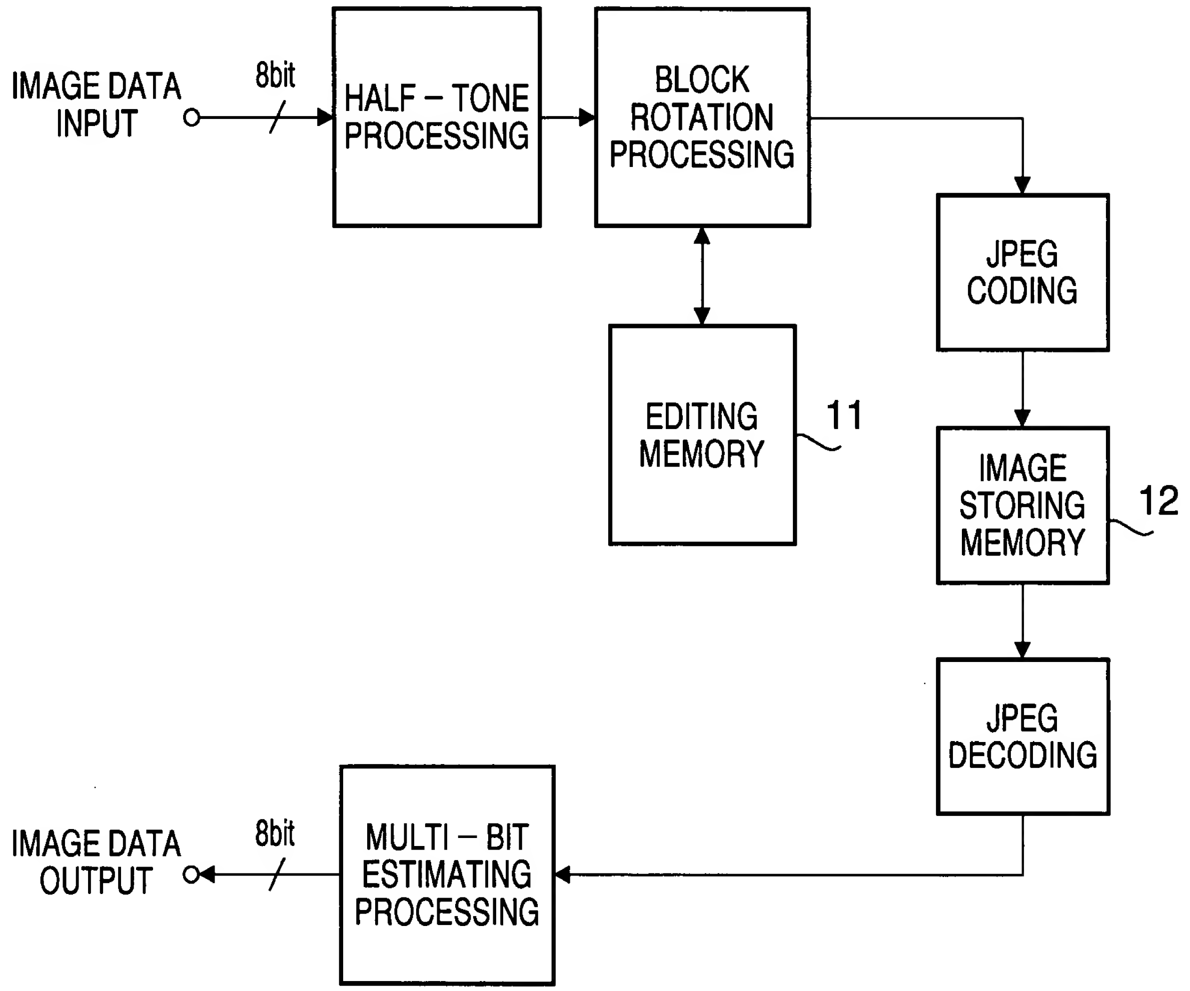


IMAGE DATA INPUT
8bit
HALF – TONE PROCESSING
BLOCK ROTATION PROCESSING
EDITING MEMORY
11
JPEG CODING
IMAGE STORING MEMORY
12
JPEG DECODING
MULTI – BIT ESTIMATING PROCESSING
8bit
IMAGE DATA OUTPUT

FIG. 2

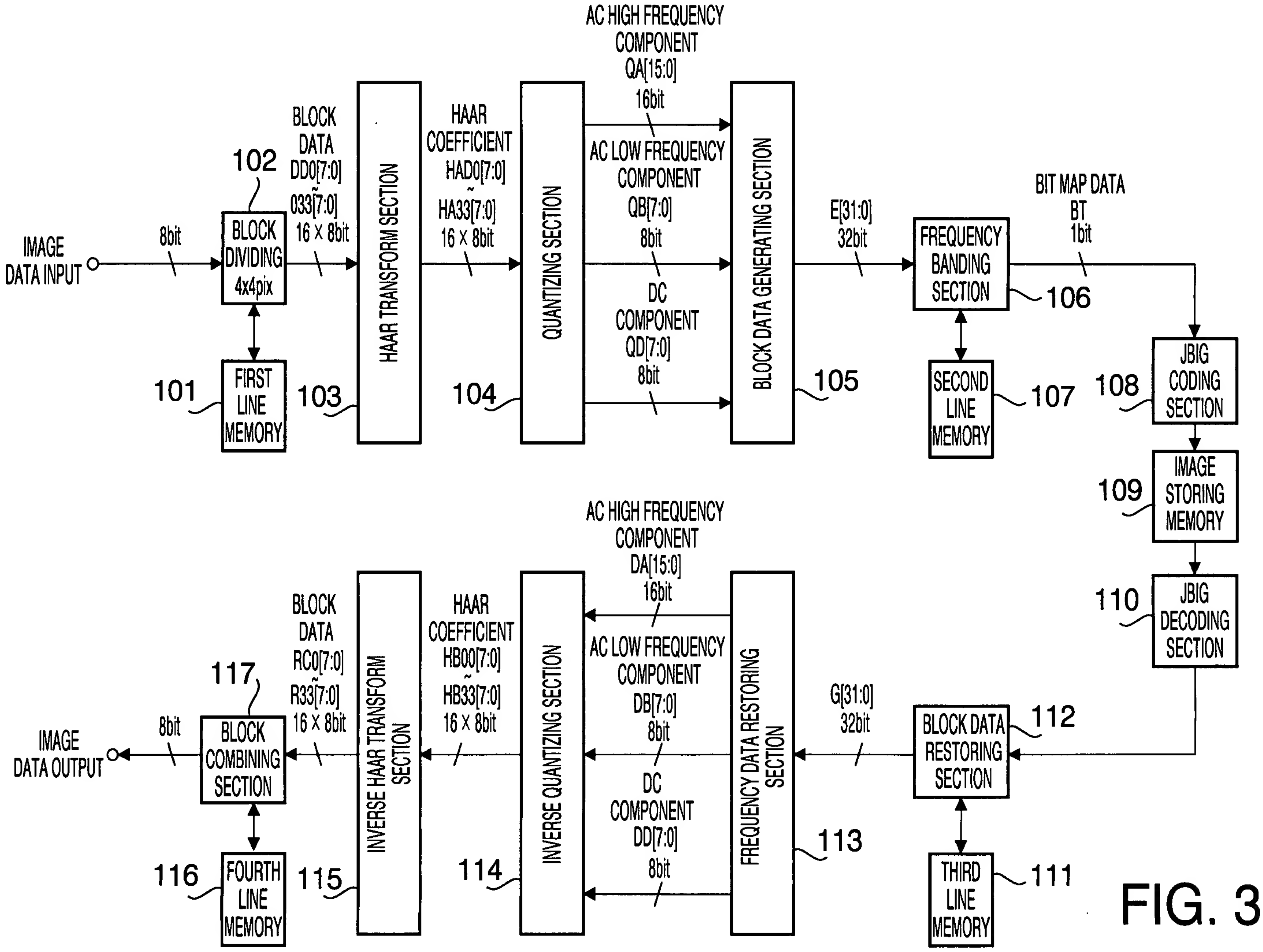
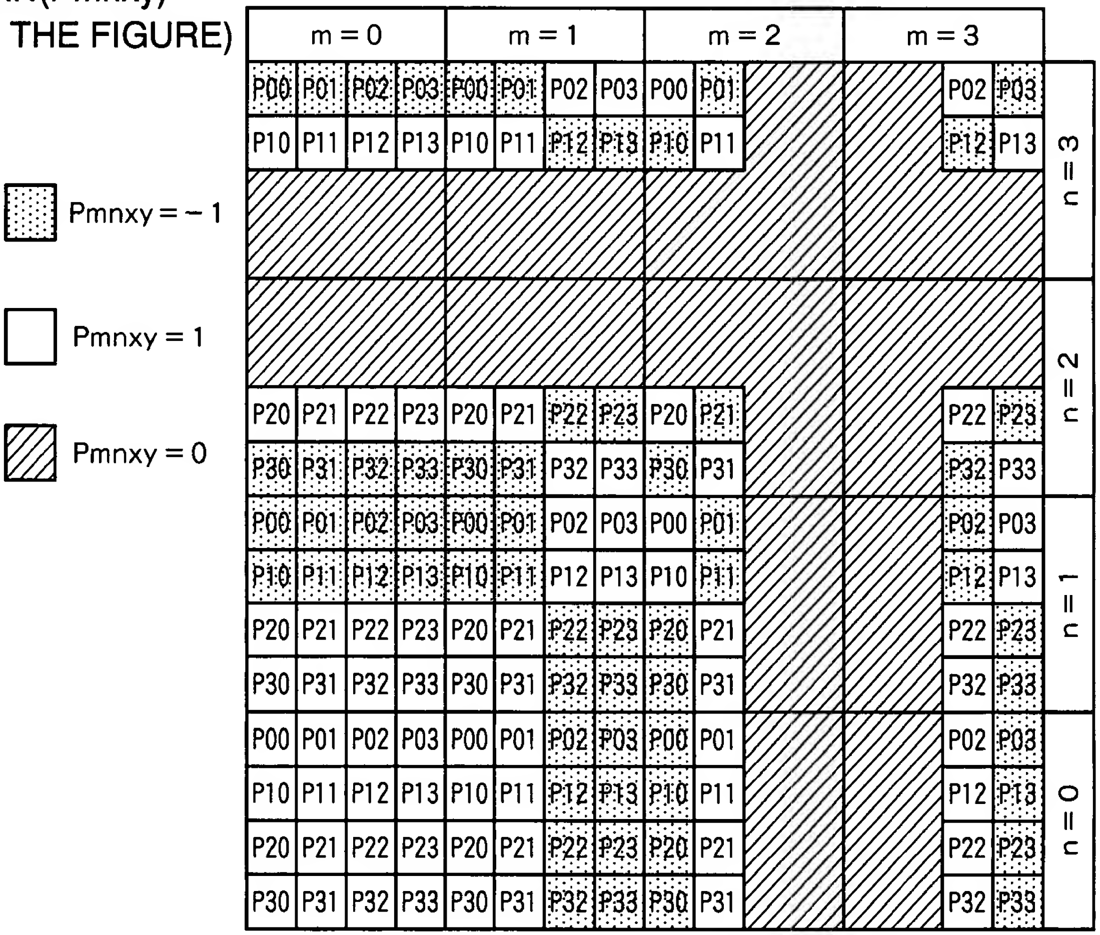


IMAGE DATA INPUT
8bit
102
BLOCK DIVIDING 4x4pix
101
FIRST LINE MEMORY
BLOCK DATA DD0[7:0] ~ 033[7:0] 16 × 8bit
103
HAAR TRANSFORM SECTION
HAAR COEFFICIENT HAD0[7:0] ~ HA33[7:0] 16 × 8bit
104
QUANTIZING SECTION
AC HIGH FREQUENCY COMPONENT QA[15:0] 16bit
AC LOW FREQUENCY COMPONENT QB[7:0] 8bit
DC COMPONENT QD[7:0] 8bit
BLOCK DATA GENERATING SECTION
105
E[31:0] 32bit
FREQUENCY BANDING SECTION
106
SECOND LINE MEMORY
107
BIT MAP DATA BT 1bit
108
JBIG CODING SECTION
109
IMAGE STORING MEMORY
110
JBIG DECODING SECTION
112
BLOCK DATA RESTORING SECTION
THIRD LINE MEMORY
111
G[31:0] 32bit
FREQUENCY DATA RESTORING SECTION
113
AC HIGH FREQUENCY COMPONENT DA[15:0] 16bit
AC LOW FREQUENCY COMPONENT DB[7:0] 8bit
DC COMPONENT DD[7:0] 8bit
INVERSE QUANTIZING SECTION
114
HAAR COEFFICIENT HB00[7:0] ~ HB33[7:0] 16 × 8bit
INVERSE HAAR TRANSFORM SECTION
115
BLOCK DATA RC0[7:0] ~ R33[7:0] 16 × 8bit
117
BLOCK COMBINING SECTION
116
FOURTH LINE MEMORY
8bit
IMAGE DATA OUTPUT

FIG. 3

PRIMARY PATTERN(Pmnxy)
(MN ARE OMITTED IN THE FIGURE)



▒ Pmnxy = − 1

□ Pmnxy = 1

▨ Pmnxy = 0

m = 0				m = 1				m = 2				m = 3				
▒ P00	▒ P01	▒ P02	▒ P03	▒ P00	▒ P01	P02	P03	P00	▒ P01	▨	▨	▨	▨	P02	▒ P03	n = 3
P10	P11	P12	P13	P10	P11	▒ P12	▒ P13	▒ P10	P11	▨	▨	▨	▨	▒ P12	P13	
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	n = 2
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	
P20	P21	P22	P23	P20	P21	▒ P22	▒ P23	P20	▒ P21	▨	▨	▨	▨	P22	▒ P23	
▒ P30	▒ P31	▒ P32	▒ P33	▒ P30	▒ P31	P32	P33	▒ P30	P31	▨	▨	▨	▨	▒ P32	P33	
▒ P00	▒ P01	▒ P02	▒ P03	▒ P00	▒ P01	P02	P03	P00	▒ P01	▨	▨	▨	▨	▒ P02	P03	n = 1
▒ P10	▒ P11	▒ P12	▒ P13	▒ P10	▒ P11	P12	P13	P10	▒ P11	▨	▨	▨	▨	▒ P12	P13	
P20	P21	P22	P23	P20	P21	▒ P22	▒ P23	▒ P20	P21	▨	▨	▨	▨	P22	▒ P23	
P30	P31	P32	P33	P30	P31	▒ P32	▒ P33	▒ P30	P31	▨	▨	▨	▨	P32	▒ P33	
P00	P01	P02	P03	P00	P01	▒ P02	▒ P03	▒ P00	P01	▨	▨	▨	▨	P02	▒ P03	n = 0
P10	P11	P12	P13	P10	P11	▒ P12	▒ P13	▒ P10	P11	▨	▨	▨	▨	P12	▒ P13	
P20	P21	P22	P23	P20	P21	▒ P22	▒ P23	▒ P20	P21	▨	▨	▨	▨	P22	▒ P23	
P30	P31	P32	P33	P30	P31	▒ P32	▒ P33	▒ P30	P31	▨	▨	▨	▨	P32	▒ P33	

FIG. 4

HA03 (AC600dpi COMPONENT)	HA13 (AC600dpi COMPONENT)	HA23 (AC600dpi COMPONENT)	HA33 (AC600dpi COMPONENT)
HA02 (AC600dpi COMPONENT)	HA12 (AC600dpi COMPONENT)	HA22 (AC600dpi COMPONENT)	HA32 (AC600dpi COMPONENT)
HA01 (AC300dpi COMPONENT)	HA11 (AC300dpi COMPONENT)	HA21 (AC600dpi COMPONENT)	HA31 (AC600dpi COMPONENT)
HA00 (DC COMPONENT)	HA10 (AC300dpi COMPONENT)	HA20 (AC600dpi COMPONENT)	HA30 (AC600dpi COMPONENT)

FIG. 5

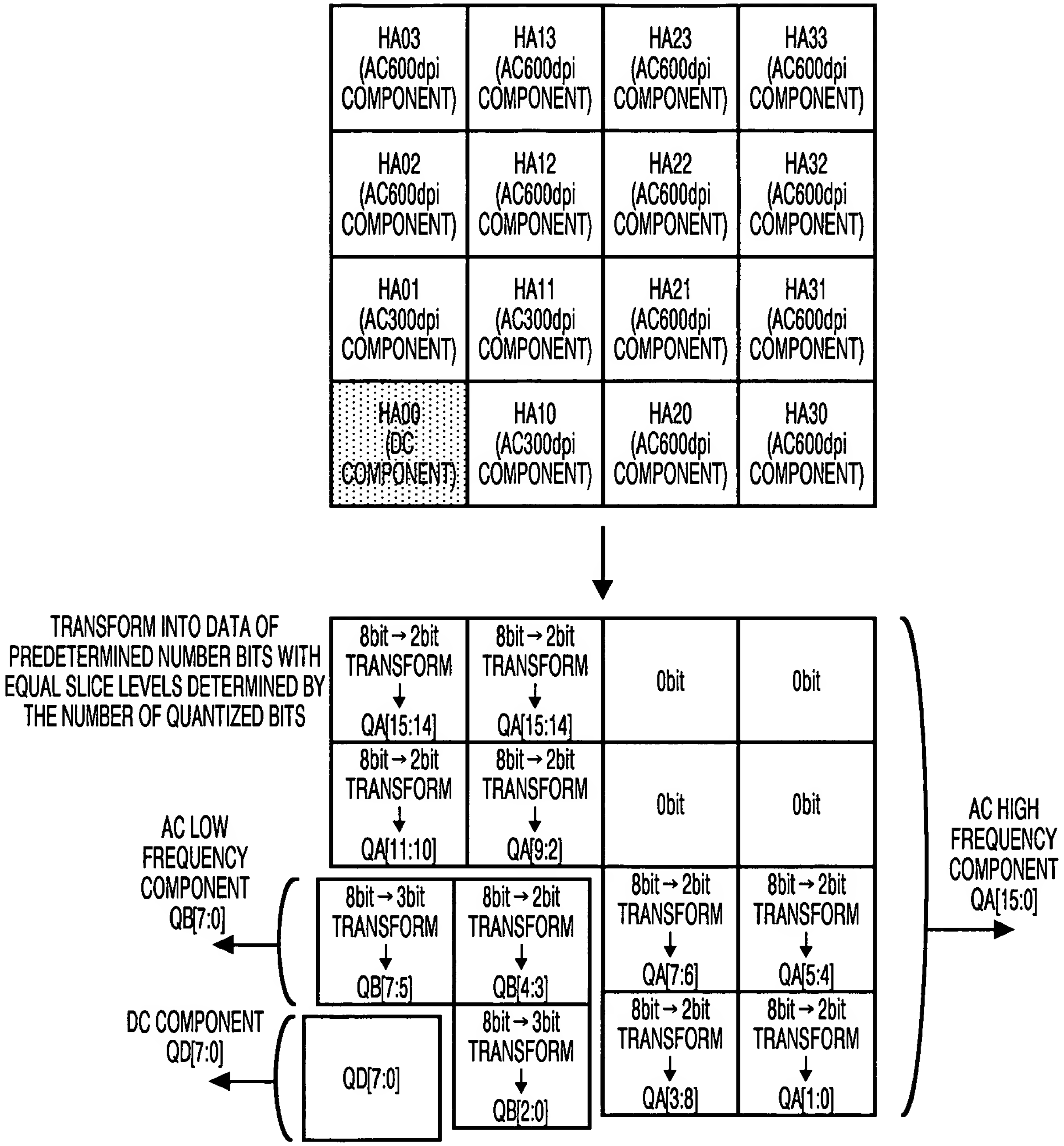
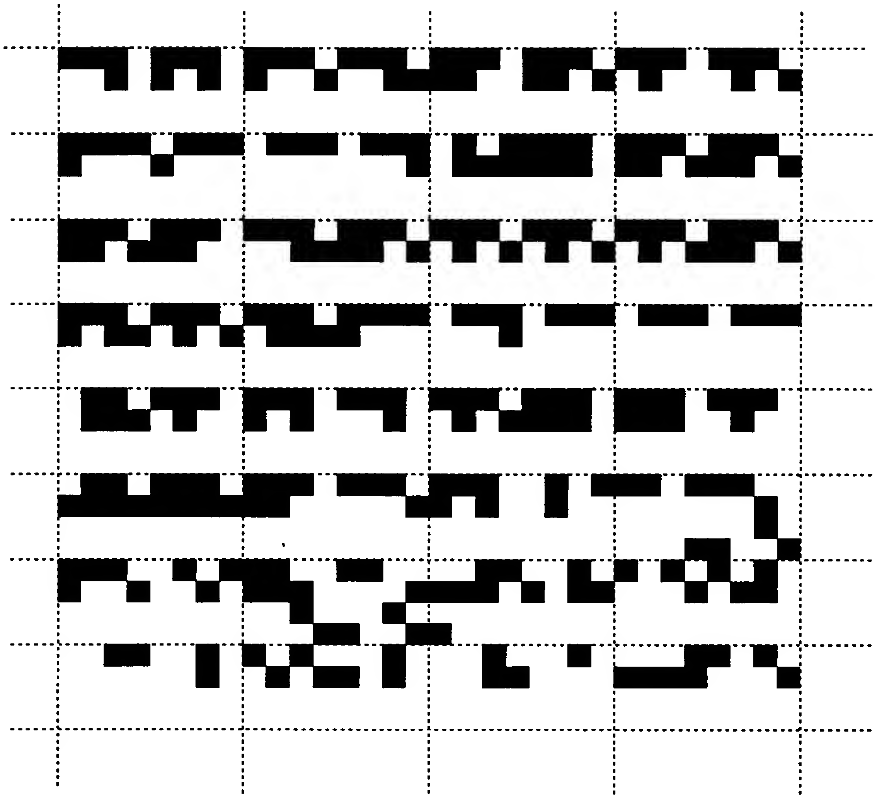

HA03 (AC600dpi COMPONENT)
HA13 (AC600dpi COMPONENT)
HA23 (AC600dpi COMPONENT)
HA33 (AC600dpi COMPONENT)
HA02 (AC600dpi COMPONENT)
HA12 (AC600dpi COMPONENT)
HA22 (AC600dpi COMPONENT)
HA32 (AC600dpi COMPONENT)
HA01 (AC300dpi COMPONENT)
HA11 (AC300dpi COMPONENT)
HA21 (AC600dpi COMPONENT)
HA31 (AC600dpi COMPONENT)
HA00 (DC COMPONENT)
HA10 (AC300dpi COMPONENT)
HA20 (AC600dpi COMPONENT)
HA30 (AC600dpi COMPONENT)
TRANSFORM INTO DATA OF PREDETERMINED NUMBER BITS WITH EQUAL SLICE LEVELS DETERMINED BY THE NUMBER OF QUANTIZED BITS
8bit→2bit TRANSFORM QA[15:14]
8bit→2bit TRANSFORM QA[15:14]
0bit
0bit
8bit→2bit TRANSFORM QA[11:10]
8bit→2bit TRANSFORM QA[9:2]
0bit
0bit
AC LOW FREQUENCY COMPONENT QB[7:0]
8bit→3bit TRANSFORM QB[7:5]
8bit→2bit TRANSFORM QB[4:3]
8bit→2bit TRANSFORM QA[7:6]
8bit→2bit TRANSFORM QA[5:4]
AC HIGH FREQUENCY COMPONENT QA[15:0]
DC COMPONENT QD[7:0]
QD[7:0]
8bit→3bit TRANSFORM QB[2:0]
8bit→2bit TRANSFORM QA[3:8]
8bit→2bit TRANSFORM QA[1:0]

FIG. 6

DC COMPONENT 8bit	F00 [7]	F00 [6]	F00 [5]	F00 [4]	F00 [3]	F00 [2]	F00 [1]	F00 [0]	F10 [7]	F10 [6]	F10 [5]	F10 [4]	F10 [3]	F10 [2]	F10 [1]	F10 [0]	F20 [7]	F20 [6]	F20 [5]	F20 [4]	F20 [3]
AC LOW FREQUENCY COMPONENT 8bit	F00 [15]	F00 [14]	F00 [13]	F00 [12]	F00 [11]	F00 [10]	F00 [9]	F00 [8]	F10 [15]	F10 [14]	F10 [13]	F10 [12]	F10 [11]	F10 [10]	F10 [9]	F10 [8]	F20 [15]	F20 [14]	F20 [13]	F20 [12]	F20 [11]
AC HIGH FREQUENCY COMPONENT 16bit	F00 [23]	F00 [22]	F00 [21]	F00 [20]	F00 [19]	F00 [18]	F00 [17]	F00 [16]	F10 [23]	F10 [22]	F10 [21]	F10 [20]	F10 [19]	F10 [18]	F10 [17]	F10 [16]	F20 [23]	F20 [22]	F20 [21]	F20 [20]	F20 [19]
	F00 [31]	F00 [30]	F00 [29]	F00 [28]	F00 [27]	F00 [26]	F00 [25]	F00 [24]	F10 [31]	F10 [30]	F10 [29]	F10 [28]	F10 [27]	F10 [26]	F10 [25]	F10 [24]	F20 [31]	F20 [30]	F20 [29]	F20 [28]	F20 [27]
DC COMPONENT 8bit	F01 [7]	F01 [6]	F01 [5]	F01 [4]	F01 [3]	F01 [2]	F01 [1]	F01 [0]	F11 [7]	F11 [6]	F11 [5]	F11 [4]	F11 [3]	F11 [2]	F11 [1]	F11 [0]	F21 [7]	F21 [6]	F21 [5]	F21 [4]	F21 [3]
AC LOW FREQUENCY COMPONENT 8bit	F01 [15]	F01 [14]	F01 [13]	F01 [12]	F01 [11]	F01 [10]	F01 [9]	F01 [8]	F11 [15]	F11 [14]	F11 [13]	F11 [12]	F11 [11]	F11 [10]	F11 [9]	F11 [8]	F21 [15]	F21 [14]	F21 [13]	F21 [12]	F21 [11]
AC HIGH FREQUENCY COMPONENT 16bit	F01 [23]	F01 [22]	F01 [21]	F01 [20]	F01 [19]	F01 [18]	F01 [17]	F01 [16]	F11 [23]	F11 [22]	F11 [21]	F11 [20]	F11 [19]	F11 [18]	F11 [17]	F11 [16]	F21 [23]	F21 [22]	F21 [21]	F21 [20]	F21 [19]
	F01 [31]	F01 [30]	F01 [29]	F01 [28]	F01 [27]	F01 [26]	F01 [25]	F01 [24]	F11 [31]	F11 [30]	F11 [29]	F11 [28]	F11 [27]	F11 [26]	F11 [25]	F11 [24]	F21 [31]	F21 [30]	F21 [29]	F21 [28]	F21 [27]
	F02 [7]	F02 [6]	F02 [5]	F02 [4]	F02 [3]	F02 [2]	F02 [1]	F02 [0]	F12 [7]	F12 [6]	F12 [5]	F12 [4]	F12 [3]	F12 [2]	F12 [1]	F12 [0]	F22 [7]	F22 [6]	F22 [5]	F22 [4]	F22 [3]
	F02 [15]	F02 [14]	F02 [13]	F02 [12]	F02 [11]	F02 [10]	F02 [9]	F02 [8]	F12 [15]	F12 [14]	F12 [13]	F12 [12]	F12 [11]	F12 [10]	F12 [9]	F12 [8]	F22 [15]	F22 [14]	F22 [13]	F22 [12]	F22 [11]

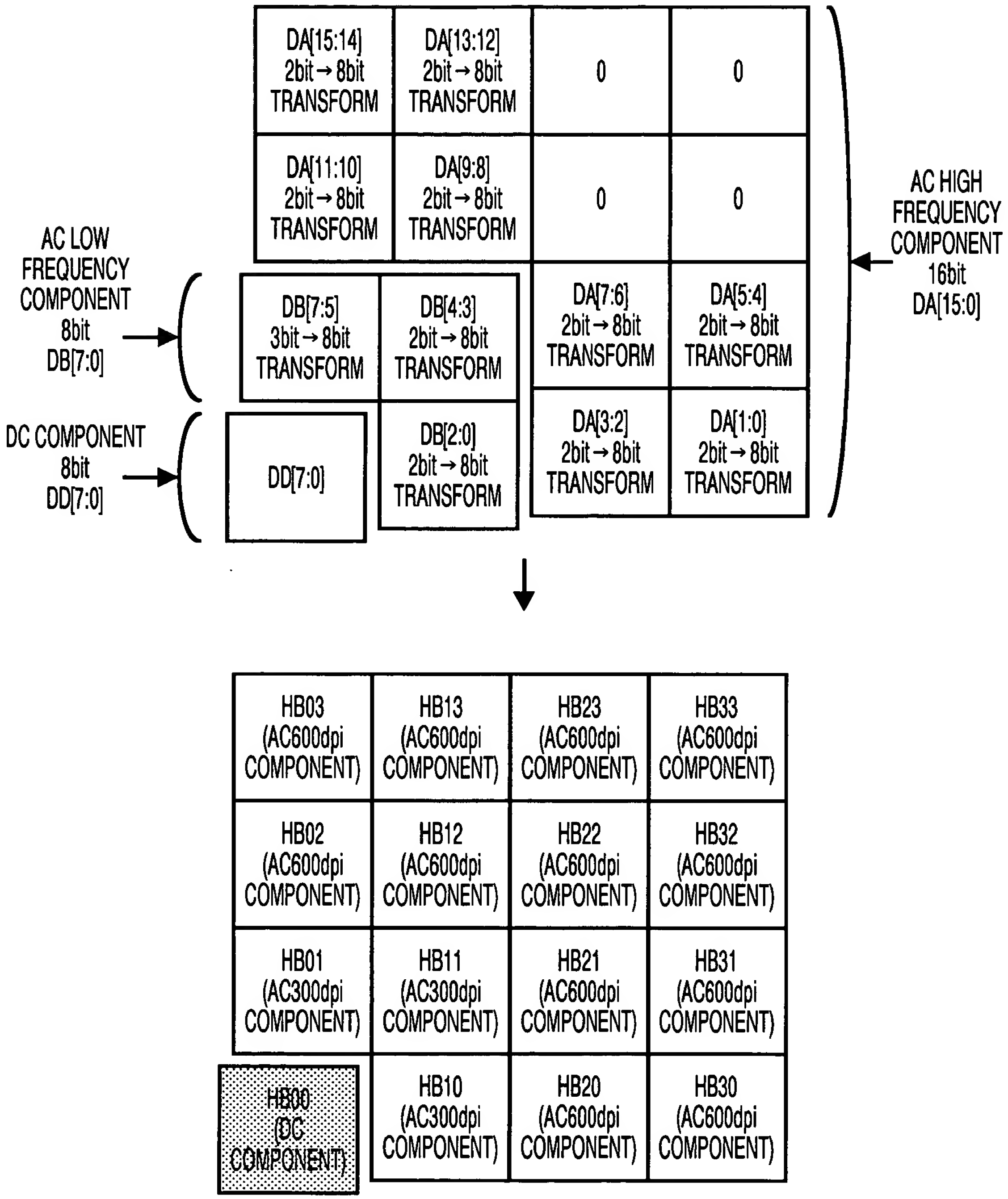
BIT MAP PATTERN ARRANGEMENT

FIG. 7



ACTUAL BIT MAP DATA SUBJECTED TO FREQUENCY BANDING

FIG. 8



INVERSE QUANTIZATION PROCESSING

FIG. 9

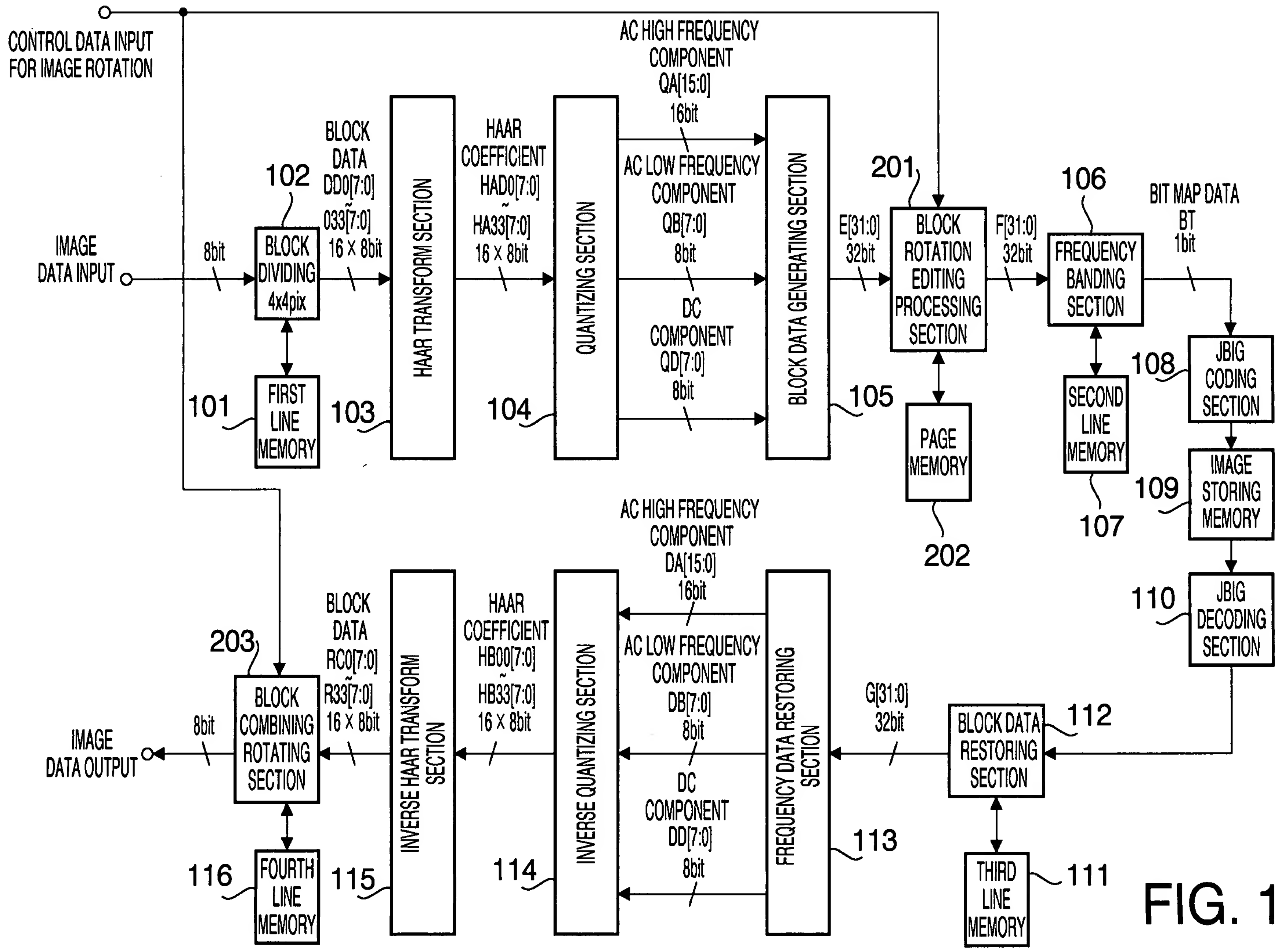
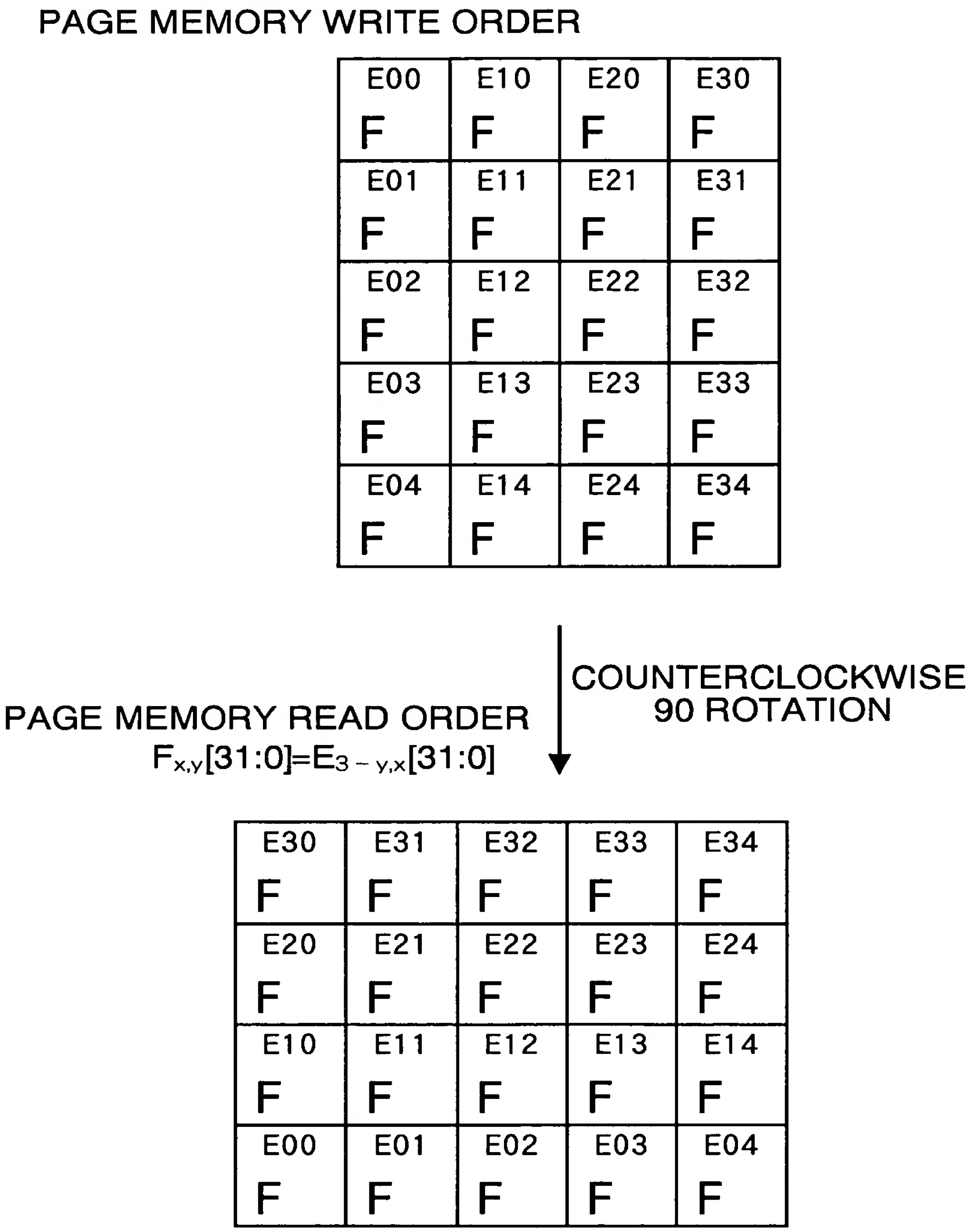

CONTROL DATA INPUT FOR IMAGE ROTATION
IMAGE DATA INPUT
8bit
102
BLOCK DIVIDING 4x4pix
101
FIRST LINE MEMORY
BLOCK DATA DD0[7:0] ~ 033[7:0] 16 × 8bit
103
HAAR TRANSFORM SECTION
HAAR COEFFICIENT HAD0[7:0] ~ HA33[7:0] 16 × 8bit
104
QUANTIZING SECTION
AC HIGH FREQUENCY COMPONENT QA[15:0] 16bit
AC LOW FREQUENCY COMPONENT QB[7:0] 8bit
DC COMPONENT QD[7:0] 8bit
BLOCK DATA GENERATING SECTION
105
E[31:0] 32bit
201
BLOCK ROTATION EDITING PROCESSING SECTION
PAGE MEMORY
202
F[31:0] 32bit
106
FREQUENCY BANDING SECTION
SECOND LINE MEMORY
107
BIT MAP DATA BT 1bit
108
JBIG CODING SECTION
109
IMAGE STORING MEMORY
110
JBIG DECODING SECTION
112
BLOCK DATA RESTORING SECTION
THIRD LINE MEMORY
111
G[31:0] 32bit
FREQUENCY DATA RESTORING SECTION
113
AC HIGH FREQUENCY COMPONENT DA[15:0] 16bit
AC LOW FREQUENCY COMPONENT DB[7:0] 8bit
DC COMPONENT DD[7:0] 8bit
INVERSE QUANTIZING SECTION
114
HAAR COEFFICIENT HB00[7:0] ~ HB33[7:0] 16 × 8bit
INVERSE HAAR TRANSFORM SECTION
115
BLOCK DATA RC0[7:0] ~ R33[7:0] 16 × 8bit
203
BLOCK COMBINING ROTATING SECTION
FOURTH LINE MEMORY
116
8bit
IMAGE DATA OUTPUT

FIG. 10



PAGE MEMORY WRITE ORDER

E00 F	E10 F	E20 F	E30 F
E01 F	E11 F	E21 F	E31 F
E02 F	E12 F	E22 F	E32 F
E03 F	E13 F	E23 F	E33 F
E04 F	E14 F	E24 F	E34 F

COUNTERCLOCKWISE
90 ROTATION

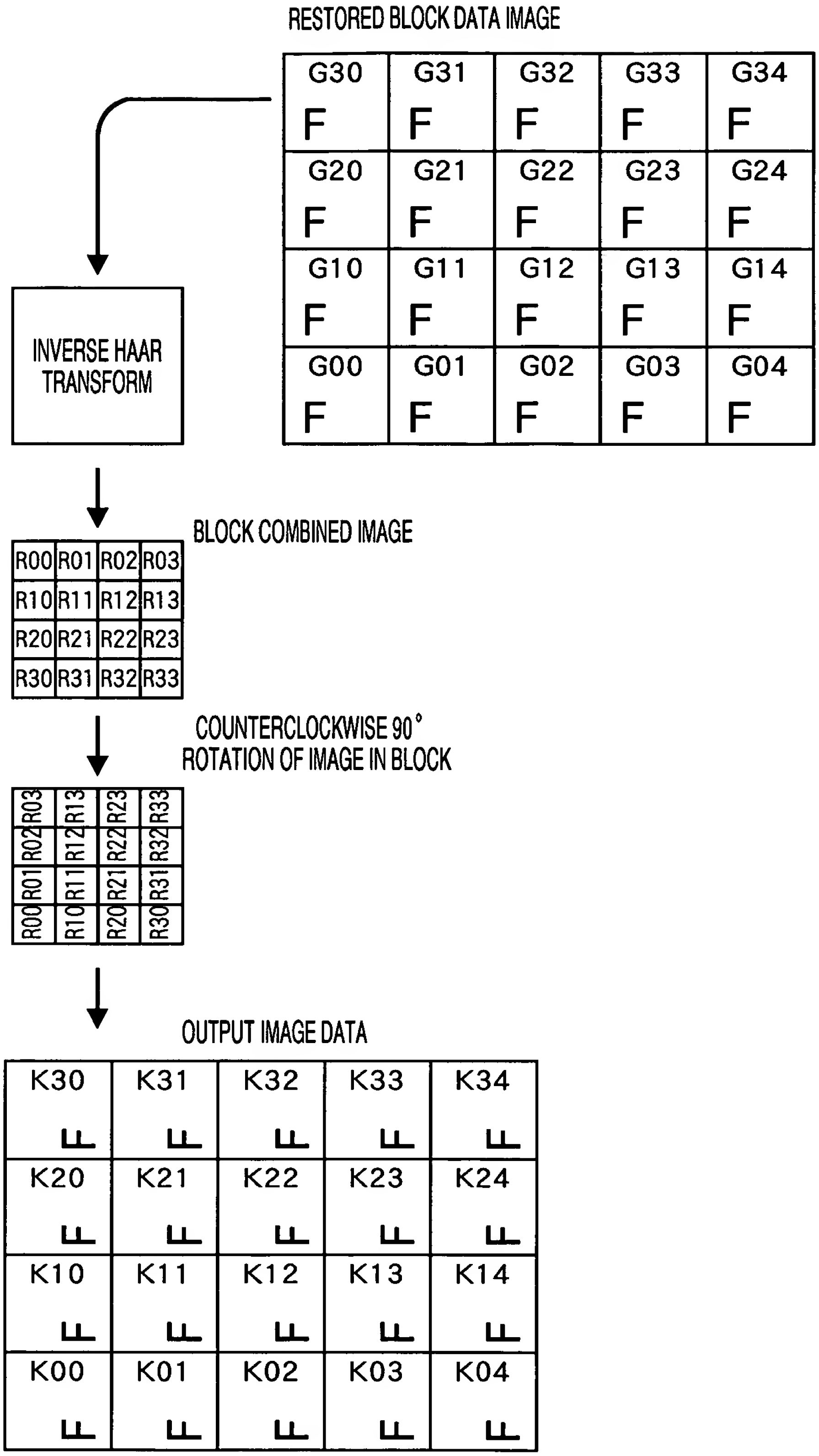
PAGE MEMORY READ ORDER
$F_{x,y}[31:0]=E_{3-y,x}[31:0]$

E30 F	E31 F	E32 F	E33 F	E34 F
E20 F	E21 F	E22 F	E23 F	E24 F
E10 F	E11 F	E12 F	E13 F	E14 F
E00 F	E01 F	E02 F	E03 F	E04 F

NOTE) F IS INDICATIVE OF DIRECTION
OF IMAGE IN BLOCK

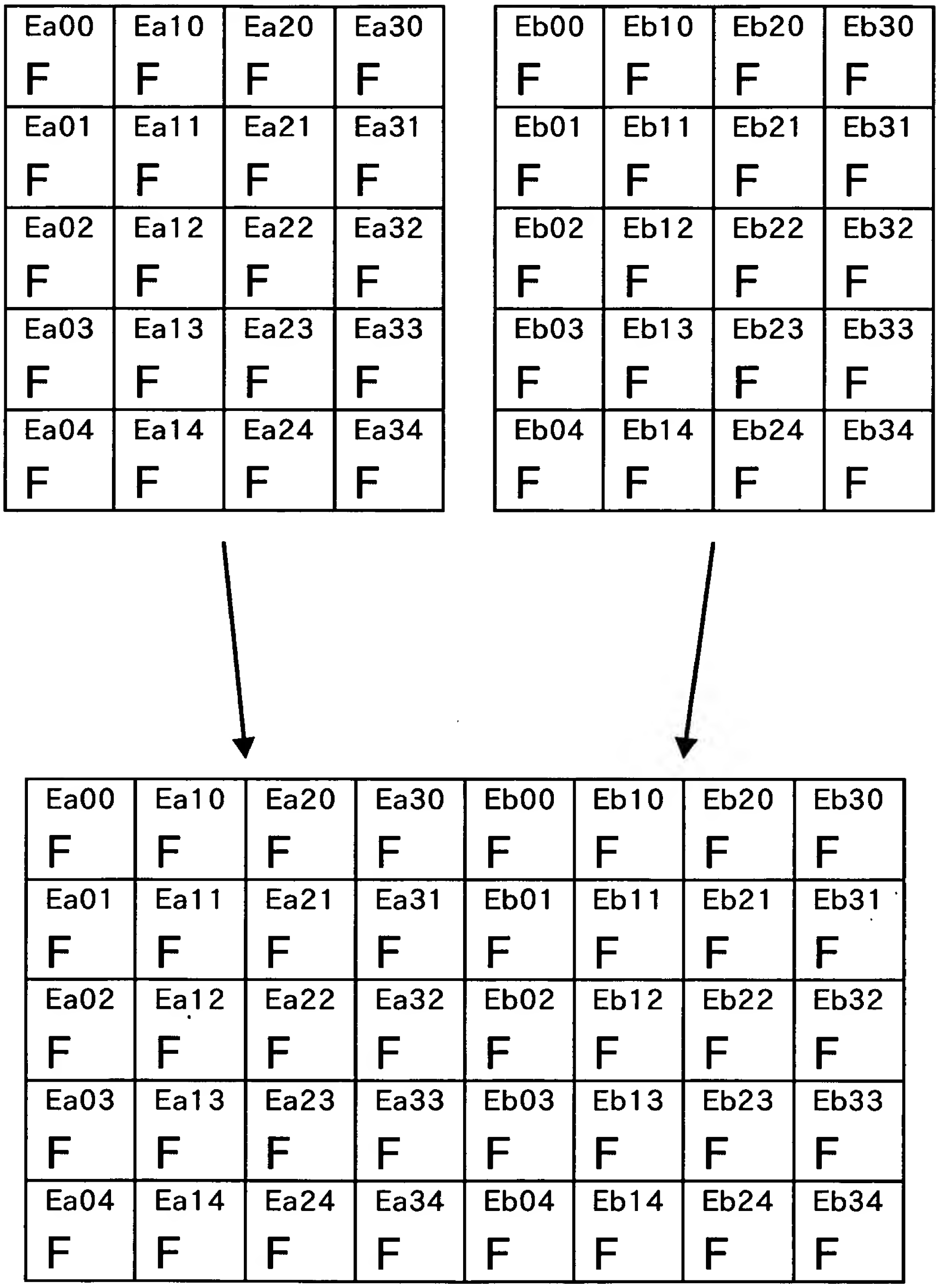
BLOCK ROTATION EDITING PROCESSING

FIG. 11



ROTATION PROCESSING OF IMAGE IN BLOCK

FIG. 12



Ea00 F	Ea10 F	Ea20 F	Ea30 F
Ea01 F	Ea11 F	Ea21 F	Ea31 F
Ea02 F	Ea12 F	Ea22 F	Ea32 F
Ea03 F	Ea13 F	Ea23 F	Ea33 F
Ea04 F	Ea14 F	Ea24 F	Ea34 F

Eb00 F	Eb10 F	Eb20 F	Eb30 F
Eb01 F	Eb11 F	Eb21 F	Eb31 F
Eb02 F	Eb12 F	Eb22 F	Eb32 F
Eb03 F	Eb13 F	Eb23 F	Eb33 F
Eb04 F	Eb14 F	Eb24 F	Eb34 F

Ea00 F	Ea10 F	Ea20 F	Ea30 F	Eb00 F	Eb10 F	Eb20 F	Eb30 F
Ea01 F	Ea11 F	Ea21 F	Ea31 F	Eb01 F	Eb11 F	Eb21 F	Eb31 F
Ea02 F	Ea12 F	Ea22 F	Ea32 F	Eb02 F	Eb12 F	Eb22 F	Eb32 F
Ea03 F	Ea13 F	Ea23 F	Ea33 F	Eb03 F	Eb13 F	Eb23 F	Eb33 F
Ea04 F	Ea14 F	Ea24 F	Ea34 F	Eb04 F	Eb14 F	Eb24 F	Eb34 F

IMAGE COMBINING EDITING PROCESSING

FIG. 13

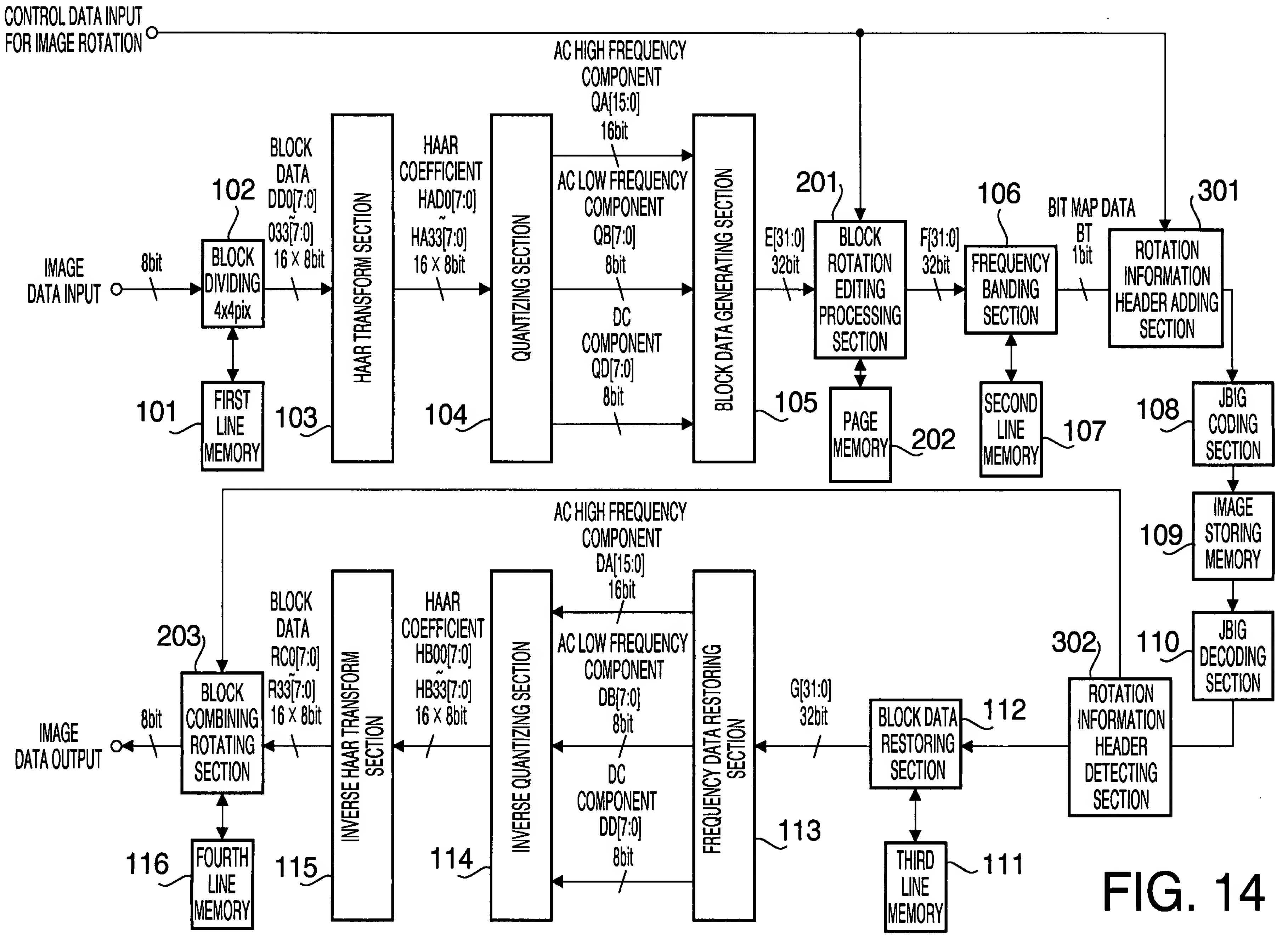

CONTROL DATA INPUT FOR IMAGE ROTATION
IMAGE DATA INPUT
8bit
102
BLOCK DIVIDING 4x4pix
101
FIRST LINE MEMORY
BLOCK DATA DD0[7:0] ~ 033[7:0] 16 × 8bit
103
HAAR TRANSFORM SECTION
HAAR COEFFICIENT HAD0[7:0] ~ HA33[7:0] 16 × 8bit
104
QUANTIZING SECTION
AC HIGH FREQUENCY COMPONENT QA[15:0] 16bit
AC LOW FREQUENCY COMPONENT QB[7:0] 8bit
DC COMPONENT QD[7:0] 8bit
BLOCK DATA GENERATING SECTION
105
E[31:0] 32bit
201
BLOCK ROTATION EDITING PROCESSING SECTION
PAGE MEMORY
202
F[31:0] 32bit
106
FREQUENCY BANDING SECTION
SECOND LINE MEMORY
107
BIT MAP DATA BT 1bit
301
ROTATION INFORMATION HEADER ADDING SECTION
108
JBIG CODING SECTION
109
IMAGE STORING MEMORY
110
JBIG DECODING SECTION
302
ROTATION INFORMATION HEADER DETECTING SECTION
112
BLOCK DATA RESTORING SECTION
THIRD LINE MEMORY
111
G[31:0] 32bit
FREQUENCY DATA RESTORING SECTION
113
AC HIGH FREQUENCY COMPONENT DA[15:0] 16bit
AC LOW FREQUENCY COMPONENT DB[7:0] 8bit
DC COMPONENT DD[7:0] 8bit
INVERSE QUANTIZING SECTION
114
HAAR COEFFICIENT HB00[7:0] ~ HB33[7:0] 16 × 8bit
INVERSE HAAR TRANSFORM SECTION
115
BLOCK DATA RC0[7:0] ~ R33[7:0] 16 × 8bit
203
BLOCK COMBINING ROTATING SECTION
FOURTH LINE MEMORY
116
8bit
IMAGE DATA OUTPUT

FIG. 14

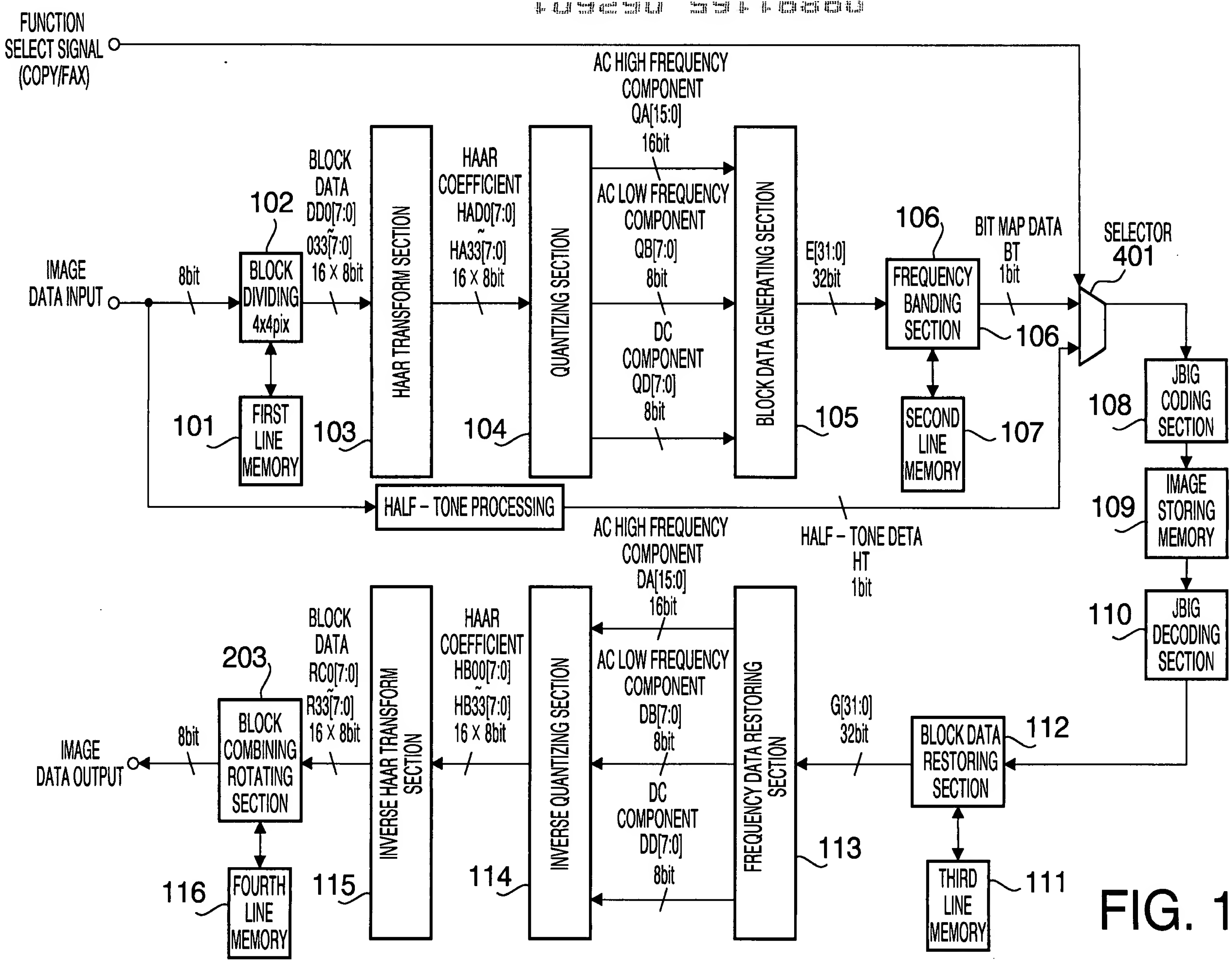

FUNCTION SELECT SIGNAL (COPY/FAX)
IMAGE DATA INPUT
8bit
102
BLOCK DIVIDING 4x4pix
101
FIRST LINE MEMORY
BLOCK DATA DD0[7:0] ~ 033[7:0] 16 X 8bit
103
HAAR TRANSFORM SECTION
HAAR COEFFICIENT HAD0[7:0] ~ HA33[7:0] 16 X 8bit
104
QUANTIZING SECTION
AC HIGH FREQUENCY COMPONENT QA[15:0] 16bit
AC LOW FREQUENCY COMPONENT QB[7:0] 8bit
DC COMPONENT QD[7:0] 8bit
BLOCK DATA GENERATING SECTION
105
E[31:0] 32bit
106
FREQUENCY BANDING SECTION
106
SECOND LINE MEMORY
107
BIT MAP DATA BT 1bit
SELECTOR 401
HALF – TONE PROCESSING
HALF – TONE DETA HT 1bit
108
JBIG CODING SECTION
109
IMAGE STORING MEMORY
110
JBIG DECODING SECTION
112
BLOCK DATA RESTORING SECTION
111
THIRD LINE MEMORY
G[31:0] 32bit
FREQUENCY DATA RESTORING SECTION
113
AC HIGH FREQUENCY COMPONENT DA[15:0] 16bit
AC LOW FREQUENCY COMPONENT DB[7:0] 8bit
DC COMPONENT DD[7:0] 8bit
INVERSE QUANTIZING SECTION
114
HAAR COEFFICIENT HB00[7:0] ~ HB33[7:0] 16 X 8bit
INVERSE HAAR TRANSFORM SECTION
115
BLOCK DATA RC0[7:0] ~ R33[7:0] 16 X 8bit
203
BLOCK COMBINING ROTATING SECTION
116
FOURTH LINE MEMORY
8bit
IMAGE DATA OUTPUT

FIG. 15

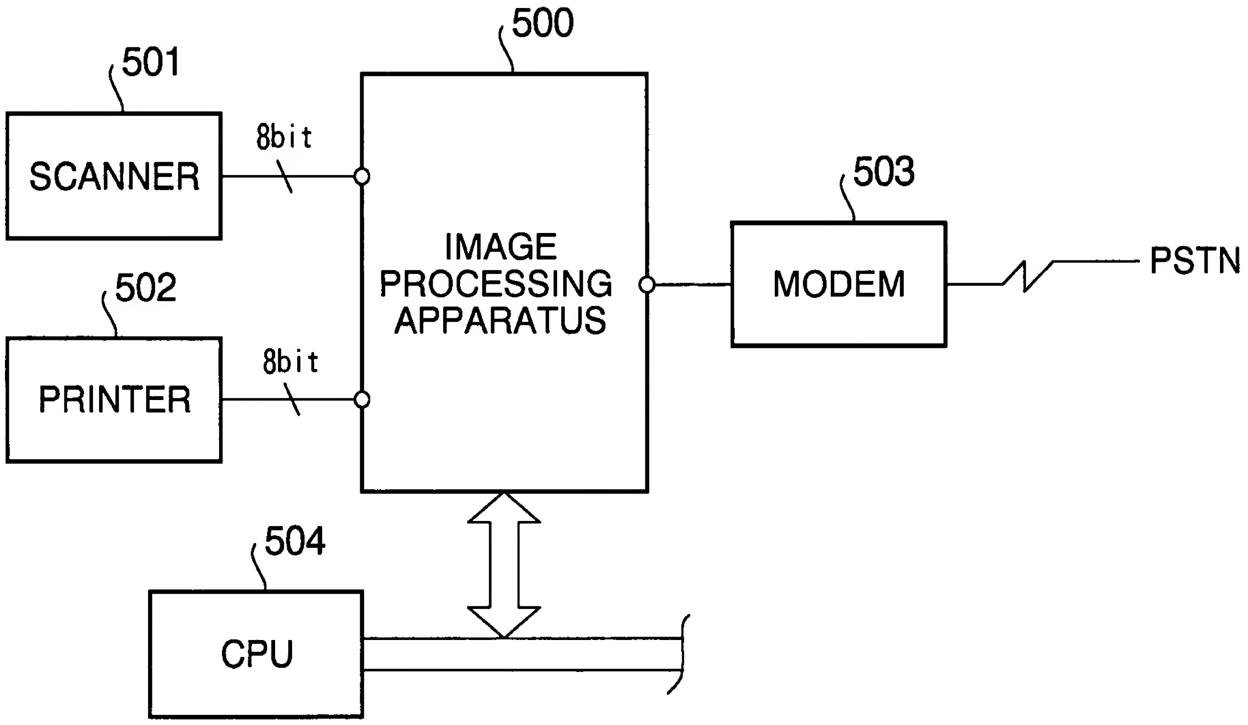

500
501
SCANNER
8bit
502
PRINTER
8bit
IMAGE
PROCESSING
APPARATUS
503
MODEM
PSTN
504
CPU

FIG. 16